JAPANESE PATENT OFFICE (JP)
PATENT KOKAI [LAID-OPEN] PUBLICATION (A)
PATENT KOKAI NO. HEI 4[1992]-184429

Int. Cl.[5]	ID Codes	Sequence Nos. for Office Use
G 03 B 21/14	A	7316-2K
G 02 B 5/30		7724-2K
27/10		7036-2K
27/28	Z	9120-2K
G 03 B 21/00	Z	7316-2K
G 09 F 9/00	360	6447-5G
9/35		7926-5G
H 04 N 5/74	A	7205-5C

Patent Application No. : Hei 2[1990]-315406

Patent Application Date : November 20, 1990

No. of Inventions : 5 (Total 5 pages in Japanese original)

Examination Request : Not requested

TITLE: POLARIZING LIGHT SOURCE DEVICE, AND PROJECTION-TYPE LIQUID CRYSTAL DISPLAY DEVICE USING THE SAME

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Agent(s): Kisaburo SUZUKI, patent agent
Includes one other.

Amendments: There are no amendments to this patent.

[note: All names, addresses, company names, and brand names are translated in the most common manner. Japanese language does not have singular or plural words unless otherwise specified with numeral prefix or general plurality suffix. translator's note]

TITLE OF THE INVENTION: Polarizing light source and projection type liquid crystal display device using the same,

CLAIMS

(1) According to a polarizing light source device that mainly consists of a light source lamp, a parabolic reflector that reflects radiated lights from said light source lamp, and a polarized light separator that separates nonpolarized lights discharged from light source device to two polarized lights which are mutually in orthogonal relationship , a polarizing light source device has characteristics as such that of said two polarized lights which are mutually in orthogonal relationship and are separated from said polarized light separator, one is converged on a light source lamp, and then, is utilized again as lights of light source .

(2) The polarizing light source device according to the claim item 1, wherein said polarized light separator uses dielectric multi-layer films to construct one of said two linear polarized lights , which are in mutually in orthogonal relationship and are included in lights of light source which enter said polarized light separator, to reflect toward light source side.

(3) The polarizing light source device according to the claim item 1 or 2, wherein surface of light emitting tube of said light source lamp shows a frost form with fine concaves and convex (凹凸).

(4) The polarizing light source device according to the claim item 1 or 2, wherein surface of light emitting tube of said light source lamp is formed of a smooth glass material; and in addition, a 1/4 wavelength panel is arranged between said light source device and said polarized light separator.

(5) According to a projection type liquid crystal display device that mainly consists of a light source device that discharges almost parallel luminous flux, a colored light separator that separates said almost parallel luminous flux to three primary color lights, a liquid crystal light valve that modulates each primary color light, a colored light synthesizer that synthesizes each modulated light, and a projection lens that enlarges and projects synthesized modulated lights, a projection type liquid crystal display device has characteristics as such that said light source device is the polarizing light source device according to the claim items 1, 2, 3, or 4.

TITLE OF THE INVENTION: Polarizing light source and projection type liquid crystal display device using the same,

CLAIMS

(1) According to a polarizing light source device that mainly consists of a light source lamp, a parabolic reflector that reflects radiated lights from said light source lamp, and a polarized light separator that separates nonpolarized lights discharged from light source device to two polarized lights which are mutually in orthogonal relationship , a polarizing light source device has characteristics as such that of said two polarized lights which are mutually in orthogonal relationship and are separated from said polarized light separator, one is converged on a light source lamp, and then, is utilized again as lights of light source .

(2) The polarizing light source device according to the claim item 1, wherein said polarized light separator uses dielectric multi-layer films to construct one of said two linear polarized lights , which are in mutually in orthogonal relationship and are included in lights of light source which enter said polarized light separator, to reflect toward light source side.

(3) The polarizing light source device according to the claim item 1 or 2, wherein surface of light emitting tube of said light source lamp shows a frost form with fine concaves and convex (凹凸).

(4) The polarizing light source device according to the claim item 1 or 2, wherein surface of light emitting tube of said light source lamp is formed of a smooth glass material; and in addition, a 1/4 wavelength panel is arranged between said light source device and said polarized light separator.

(5) According to a projection type liquid crystal display device that mainly consists of a light source device that discharges almost parallel luminous flux, a colored light separator that separates said almost parallel luminous flux to three primary color lights, a liquid crystal light valve that modulates each primary color light, a colored light synthesizer that synthesizes each modulated light, and a projection lens that enlarges and projects synthesized modulated lights, a projection type liquid crystal display device has characteristics as such that said light source

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DETAILED EXPLANATION OF THE INVENTION

[Field of industrial application]

This invention relates to a projection type liquid crystal display device that enlarges and displays projected image that is input to a liquid crystal panel; or a polarizing light source device that utilizes projection type liquid crystal display device.

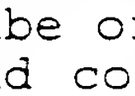
[Prior art]

As illustrated in Figure 2, conventional projection type liquid crystal display device mainly consists of a light source device (201), a light valve comprising polarization panels (202), (205), and a liquid crystal panel (204), and a projection lens (206); and nonpolarized light (207) from light source device is directly polarized at polarization panel (202) and enters liquid crystal panel (204), and is detected with the polarization panel (205) and becomes luminous flux including projected image information; and this is enlarged and projected by the projection lens (206). As explained above, according to the conventional method that takes out linear polarized lights from lights of light source is generally conducted by taking out linear polarized lights with high polarization degree by entering nonpolarized lights from the light source device directly into a polarization plate.

[Subjects solved by this invention]

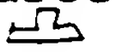
According to said prior art, when quantity of light is increased in order to brighten a display screen, temperature of polarization panel and a liquid crystal panel that is arranged nearby increases significantly; and therefore, performance degradation of polarization panel and characteristics changes of liquid crystal panel tend to occur. In order to prevent this, as shown with a cooling fan (203) in Figure 2, problem point of prior art is as such that a high capacity cooling is required. In addition, it also shows a problem point that of the two linear polarized lights which are in mutually in orthogonal relationship and are included in lights of light source , one of them is discarded through an absorption by the polarization panel to show a very poor efficiency. This invention is designed to solve these problem points; and its purpose is to offer a projection type liquid crystal display device that provides easy cooling of liquid crystal light valve, and above all, it provides a bright display screen with high utilization efficiency of lights of light source.

[Measures used to solve the subjects]

According to the polarizing light source device of this invention, it shows characteristics as such that mainly consists of a light source lamp, a parabolic reflector that reflects lights radiated from said light source lamp, and a polarized light separator that separates nonpolarized lights discharged from the light source device into two polarized lights in mutual orthogonal relationship; and of the two polarized lights in mutual orthogonal relationship which are separated by said polarized light separator, one is directly discharged to be utilized while the other is converged on a light source lamp, and then, is utilized as lights of light source . Furthermore, said polarized light separator shows characteristics as such that is constructed in such manner so one of the two linear polarized lights in mutual orthogonal relationship and are included in lights of light source which enter said polarized light separator through use of dielectric multi-layer films is reflected toward light source side. In addition, method of conversion of polarized light that is returned to a light source lamp to other polarized light has characteristics as such that is conducted through arrangement of surface of light emitting tube of light source lamp as a frost form with fine concaves and convex (), or to form light emitting tube of light source lamp with a glass material showing smooth surface to place a 1/4 wavelength panel between said light source device and said polarized light separator.

In addition, the projection type liquid crystal display device of this invention has characteristics as such that mainly consists of a light source device that discharges almost parallel luminous flux, a colored light separator that separates said almost parallel luminous flux to three primary colored lights, a liquid crystal light valve that modulates each primary color, a colored light synthesizer that synthesizes each modulated light, and a projection lens that enlarges and projects synthesized modulated lights; and said light source device is of said polarized light source device.

[Measures used to solve the subjects]

According to the polarizing light source device of this invention, it shows characteristics as such that mainly consists of a light source lamp, a parabolic reflector that reflects lights radiated from said light source lamp, and a polarized light separator that separates nonpolarized lights discharged from the light source device into two polarized lights in mutual orthogonal relationship; and of the two polarized lights in mutual orthogonal relationship which are separated by said polarized light separator, one is directly discharged to be utilized while the other is converged on a light source lamp, and then, is utilized as lights of light source . Furthermore, said polarized light separator shows characteristics as such that is constructed in such manner so one of the two linear polarized lights in mutual orthogonal relationship and are included in lights of light source which enter said polarized light separator through use of dielectric multi-layer films is reflected toward light source side. In addition, method of conversion of polarized light that is returned to a light source lamp to other polarized light has characteristics as such that is conducted through arrangement of surface of light emitting tube of light source lamp as a frost form with fine concaves and convex (), or to form light emitting tube of light source lamp with a glass material showing smooth surface to place a 1/4 wavelength panel between said light source device and said polarized light separator.

In addition, the projection type liquid crystal display device of this invention has characteristics as such that mainly consists of a light source device that discharges almost parallel luminous flux, a colored light separator that separates said almost parallel luminous flux to three primary colored lights, a liquid crystal light valve that modulates each primary color, a colored light synthesizer that synthesizes each modulated light, and a projection lens that enlarges and projects synthesized modulated lights; and said light source device is of said polarized light source device.

DETAILED EXPLANATION OF THE INVENTION

[Field of industrial application]

This invention relates to a projection type liquid crystal display device that enlarges and displays projected image that is input to a liquid crystal panel; or a polarizing light source device that utilizes projection type liquid crystal display device.

[Prior art]

As illustrated in Figure 2, conventional projection type liquid crystal display device mainly consists of a light source device (201), a light valve comprising polarization panels (202), (205), and a liquid crystal panel (204), and a projection lens (206); and nonpolarized light (207) from light source device is directly polarized at polarization panel (202) and enters liquid crystal panel (204), and is detected with the polarization panel (205) and becomes luminous flux including projected image information; and this is enlarged and projected by the projection lens (206). As explained above, according to the conventional method that takes out linear polarized lights from lights of light source is generally conducted by taking out linear polarized lights with high polarization degree by entering nonpolarized lights from the light source device directly into a polarization plate.

[Subjects solved by this invention]

According to said prior art, when quantity of light is increased in order to brighten a display screen, temperature of polarization panel and a liquid crystal panel that is arranged nearby increases significantly; and therefore, performance degradation of polarization panel and characteristics changes of liquid crystal panel tend to occur. In order to prevent this, as shown with a cooling fan (203) in Figure 2, problem point of prior art is as such that a high capacity cooling is required. In addition, it also shows a problem point that of the two linear polarized lights which are in mutually in orthogonal relationship and are included in lights of light source , one of them is discarded through an absorption by the polarization panel to show a very poor efficiency. This invention is designed to solve these problem points; and its purpose is to offer a projection type liquid crystal display device that provides easy cooling of liquid crystal light valve, and above all, it provides a bright display screen with high utilization efficiency of lights of light source.

[Actions]

According to above-explained constitution of this invention, nonpolarized lights which are discharged from a light source device comprising a light source lamp and parabolic reflector enters dielectric multi-layer film within a polarized light separator, and is separated into two linear polarized lights showing mutually orthogonal relationship; and the one of such is utilized as it is. Furthermore, the other polarized light is reflected toward light source side; and after it is reflected at parabolic reflector, it is converged on a light source lamp. When surface of light emitting tube of light source lamp is treated in a frost form with concaves and convex (凸 凸), polarized lights which are converged and are scattered become nonpolarized lights. And therefore, these nonpolarized lights are again reflected at the parabolic reflector in the same manner as the first nonpolarized lights which are discharged, and become almost parallel luminous flux, and enter polarized light separator and are separated as polarized lights in mutual orthogonal relationship. In addition, when a surface of light emitting tube of light source lamp happens to be smooth , and degree of polarization of converged lights which are transmitted happens to show hardly any changes, it is recommended to install a 1/4 wavelength panel between light source device and polarized light separator. In this case, one of the polarized light that is reflected from a dielectric multi-layer films within said polarized light separator passes through 1/4 wavelength panel and becomes circularly polarized light, and moves toward light source device side, and is reflected at parabolic reflector, and returns to the light source lamp. Furthermore, because this circularly polarized light becomes polarized light that is orthogonal to polarized light direction of the time when is reflected at polarized light separator for the first time after it is reflected at parabolic reflector again in the same manner as light source light, and then passes through 1/4 wavelength panel once more, it passes through the polarized light separator. And therefore, almost all lights of light source are converted to linear polarized lights at the end.

[Examples]

Examples of this invention are explained below in reference with attached Figures.

Figure 1 illustrates a constitutional diagonal view that shows the first example of this invention's polarizing light source device. Luminous flux that is radiated from a light source lamp (101) (halogen lamp, metal halide lamp, or xenon lamp and the like) is reflected at parabolic reflector (102) and becomes almost parallel nonpolarized lights (105) and enter a polarized light separator that consists of a prism (103) and dielectric multi-layer films (104). Both two dielectric multi-layer films (104) show characteristics as such that they reflect s-polarized light over entire visible region and transmit p-polarized light; and in addition, because two dielectric multi-layer films (104) are in mutually orthogonal form, of the nonpolarized lights (105) which enter a polarized light separator, p-polarized light is all transmitted while s-polarized light is reflected at two dielectric multi-layer films (104), and returns to the light source side. As said reflected s-polarized lights (106) is of almost parallel lights, they are reflected at parabolic reflector (102), and return to the light source lamp (101). The surface of light emitting tube of light source lamp (101) is designed as a frost structure with concaves and convex; and therefore, polarization direction of the s-polarized lights which enter light source lamp (101) is disturbed and they become nonpolarized lights; and then, are radiated as lights of light source to repeat the same as explained previously. And therefore, as some of the s-polarized lights reflected from the polarized light separator are converted to p-polarized lights and are utilized, it provides high utilization efficiency of lights of light source.

Figure 3 illustrates a constitutional plane view of the second example of this invention's polarizing light source device. Nonpolarized lights (304) radiated from a light source lamp (101) (xenon lamp, metal halide lamp and the like) are reflected at parabolic reflector, and move toward polarized light separator side (303). Prior to entering the polarized light separator (303), the nonpolarized lights (304) pass through a 1/4 wavelength panel; however, the nonpolarized lights (304) remain as nonpolarized lights even after passing. As explained previously, the polarized light separator (303) consists of mutually orthogonal dielectric multi-layer films and prism; and as each dielectric multi-layer film has characteristics of transmitting p-polarized light while reflecting s-polarized light, only the p-polarized light (305) of the nonpolarized lights (304) which enter from light source side is transmitted; and s-polarized light (306) is reflected twice and returns to light source side. At this time, it becomes circularly polarized light (307) by passing through 1/4 wavelength panel; and is

[Examples]

Examples of this invention are explained below in reference with attached Figures.

Figure 1 illustrates a constitutional diagonal view that shows the first example of this invention's polarizing light source device. Luminous flux that is radiated from a light source lamp (101) (halogen lamp, metal halide lamp, or xenon lamp and the like) is reflected at parabolic reflector (102) and becomes almost parallel nonpolarized lights (105) and enter a polarized light separator that consists of a prism (103) and dielectric multi-layer films (104). Both two dielectric multi-layer films (104) show characteristics as such that they reflect s-polarized light over entire visible region and transmit p-polarized light; and in addition, because two dielectric multi-layer films (104) are in mutually orthogonal form, of the nonpolarized lights (105) which enter a polarized light separator, p-polarized light is all transmitted while s-polarized light is reflected at two dielectric multi-layer films (104), and returns to the light source side. As said reflected s-polarized lights (106) is of almost parallel lights, they are reflected at parabolic reflector (102), and return to the light source lamp (101). The surface of light emitting tube of light source lamp (101) is designed as a frost structure with concaves and convex; and therefore, polarization direction of the s-polarized lights which enter light source lamp (101) is disturbed and they become nonpolarized lights; and then, are radiated as lights of light source to repeat the same as explained previously. And therefore, as some of the s-polarized lights reflected from the polarized light separator are converted to p-polarized lights and are utilized, it provides high utilization efficiency of lights of light source.

Figure 3 illustrates a constitutional plane view of the second example of this invention's polarizing light source device. Nonpolarized lights (304) radiated from a light source lamp (101) (xenon lamp, metal halide lamp and the like) are reflected at parabolic reflector, and move toward polarized light separator side (303). Prior to entering the polarized light separator (303), the nonpolarized lights (304) pass through a 1/4 wavelength panel; however, the nonpolarized lights (304) remain as nonpolarized lights even after passing. As explained previously, the polarized light separator (303) consists of mutually orthogonal dielectric multi-layer films and prism; and as each dielectric multi-

light (306) is reflected twice and returns to light source side. At this time, it becomes circularly polarized light (307) by passing through 1/4 wavelength panel; and is

[Actions]

According to above-explained constitution of this invention, nonpolarized lights which are discharged from a light source device comprising a light source lamp and parabolic reflector enters dielectric multi-layer film within a polarized light separator, and is separated into two linear polarized lights showing mutually orthogonal relationship; and the one of such is utilized as it is. Furthermore, the other polarized light is reflected toward light source side; and after it is reflected at parabolic reflector, it is converged on a light source lamp. When surface of light emitting tube of light source lamp is treated in a frost form with concaves and convex ( ), polarized lights which are converged and are scattered become nonpolarized lights. And therefore, these nonpolarized lights are again reflected at the parabolic reflector in the same manner as the first nonpolarized lights which are discharged, and become almost parallel luminous flux, and enter polarized light separator and are separated as polarized lights in mutual orthogonal relationship. In addition, when a surface of light emitting tube of light source lamp happens to be smooth , and degree of polarization of converged lights which are transmitted happens to show hardly any changes, it is recommended to install a 1/4 wavelength panel between light source device and polarized light separator. In this case, one of the polarized light that is reflected from a dielectric multi-layer films within said polarized light separator passes through 1/4 wavelength panel and becomes circularly polarized light, and moves toward light source device side, and is reflected at parabolic reflector, and returns to the light source lamp. Furthermore, because this circularly polarized light becomes polarized light that is orthogonal to polarized light direction of the time when is reflected at polarized light separator for the first time after it is reflected at parabolic reflector again in the same manner as light source light, and then passes through 1/4 wavelength panel once more, it passes through the polarized light separator. And therefore, almost all lights of light source are converted to linear polarized lights at the end.

reflected at parabolic reflector (102) and becomes reversal circularly polarized light (308) and returns to the light source lamp. As light emitting tube of light source lamp (101) is made of a clear glass material, circularly polarized light (308) passes through light source lamp while retaining its polarization characteristics as they are. Then, the circularly polarized light (308) that exits light source lamp (101) again is reflected at parabolic reflector (102), and again becomes reversal circularly polarized light (309). Then, it passes through 1/4 wavelength panel (301), and becomes linear polarized light (310); however, as the main sectional planes of this 1/4 wavelength panel (301) and 1/4 wavelength panel (302) are mutually in orthogonal relationship, linear polarized light (310) is the p-polarized light to the dielectric multi-layer films, and it passes through said polarized light separator. And therefore, almost all the nonpolarized lights (304) which enter polarized light separator are converted to linear polarized lights.

Figure 4 illustrates a constitutional plane view of projection type liquid crystal display device that is constructed by using this invention's polarizing light source device. Almost all nonpolarized lights (408) from a light source device comprising light source lamp (101) and parabolic reflector (102) are converted to linear polarized lights by 1/4 wavelength panel (401) and polarized light separator (402). Although 6 dielectric multi-layer films are used in order to reduce the thickness of polarized light separator in this polarizing light source device, it is of the same principles as shown in the Figure 3 that allows transmission of p-polarized light and reflection of s-polarized light. The linear polarized lights (409) discharged form polarizing light source device show angle dependence to the polarized light separator (402) and nonpolarized lights from the light source device are not the perfect parallel lights; and therefore, that degree of polarization remains insufficient to enter the liquid crystal panel (404), and show reduced contrast ratio of display screen as they are. And therefore, they are passed through polarization panel (403) to set to linear polarized lights with high degree of polarization. The luminous flux that enters this polarization panel (403) hardly includes s-polarized light varying from the nonpolarized lights (207) which enter the polarization panel (202) of the case of conventional projection type liquid crystal display device shown in the Figure 2; and therefore, polarization

case. And therefore, as it is possible to utilize a polarization panel with poor polarization characteristics, that is to say, the one that shows high overall

transmissivity, it provides high utilization efficiency of luminous flux. In addition, as luminous flux that is absorbed in the polarization panel (403) is fairly small, temperature rise on polarization panel (403) hardly occurs, and does not require an installation of cooling fan. The linear polarized lights which pass through polarization panel (403) are modulated at liquid panel (404), and then, they are detected at the polarization panel (405), and are enlarged and projected with lens (406), and are input to the liquid crystal panel (404) to form a projected image on a screen (407). Although this case illustrates monochrome constitution, it is possible to display a colored projected image through arrangement of colored light separator with dichromic mirror between polarized light separator (402) and polarization panel (403) to separate to three primary colors, and then, after modulating each luminous flux with light valve, modulated lights of three primary colors may be synthesized by a dichromic mirror, and are enlarged and projected through a lens.

[Effects of this invention]

According to this invention explained above, effects of fairly high utilization efficiency of lights of light source and brighter display screen and easy cooling of light valve may be attained through use of polarizing light source device that utilizes one of the two linear polarized lights ,which are in mutual orthogonal relationship and are included in nonpolarized lights from a light source of light source device of projection type liquid crystal display device, is returned to the light source lamp once, and then, some of such light is converted to the polarized light that is same as the other linear polarized light. In addition, because linear polarized light with fairly high degree of polarization enters polarization panel at luminous flux incidental side of liquid crystal light valve, it is possible to use such polarization panel showing fairly poor polarization characteristics, in other words, the one showing high overall transmissivity.

BRIEF EXPLANATION OF THE FIGURES

Figure 1 illustrates a constitutional diagonal view of first example of this invention's polarizing light source device.

Figure 2 illustrates a constitutional diagonal view that shows a constitution of conventional projection type liquid crystal display device.

Figure 3 shows a constitutional plane view of second example of this invention's polarizing light source device.

transmissivity, it provides high utilization efficiency of luminous flux. In addition, as luminous flux that is absorbed in the polarization panel (403) is fairly small, temperature rise on polarization panel (403) hardly occurs, and does not require an installation of cooling fan. The linear polarized lights which pass through polarization panel (403) are modulated at liquid panel (404), and then, they are detected at the polarization panel (405), and are enlarged and projected with lens (406), and are input to the liquid crystal panel (404) to form a projected image on a screen (407). Although this case illustrates monochrome constitution, it is possible to display a colored projected image through arrangement of colored light separator with dichromic mirror between polarized light separator (402) and polarization panel (403) to separate to three primary colors, and then, after modulating each luminous flux with light valve, modulated lights of three primary colors may be synthesized by a dichromic mirror, and are enlarged and projected through a lens.

[Effects of this invention]

According to this invention explained above, effects of fairly high utilization efficiency of lights of light source and brighter display screen and easy cooling of light valve may be attained through use of polarizing light source device that utilizes one of the two linear polarized lights ,which are in mutual orthogonal relationship and are included in nonpolarized lights from a light source of light source device of projection type liquid crystal display device, is returned to the light source lamp once, and then, some of such light is converted to the polarized light that is same as the other linear polarized light. In addition, because linear polarized light with fairly high degree of polarization enters polarization panel at luminous flux incidental side of liquid crystal light valve, it is possible to use such polarization panel showing fairly poor polarization characteristics, in other words, the one showing high overall transmissivity.

BRIEF EXPLANATION OF THE FIGURES

Figure 1 illustrates a constitutional diagonal view of first example of this invention's polarizing light source device.

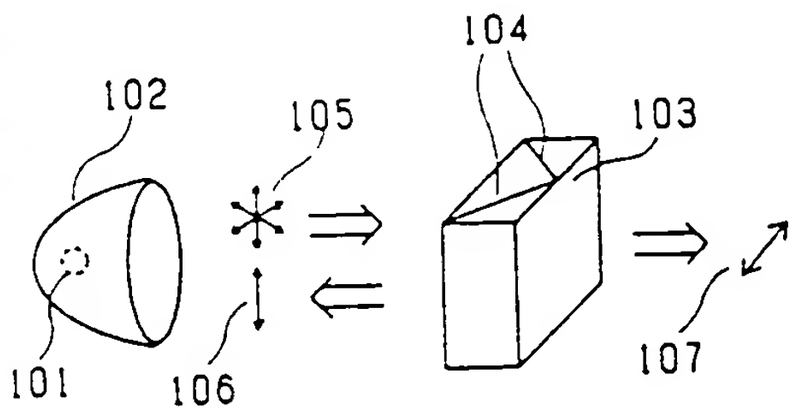
Figure 2 illustrates a constitutional diagonal view that shows a constitution of conventional projection type liquid crystal display device.

reflected at parabolic reflector (102) and becomes reversal circularly polarized light (308) and returns to the light source lamp. As light emitting tube of light source lamp (101) is made of a clear glass material, circularly polarized light (308) passes through light source lamp while retaining its polarization characteristics as they are. Then, the circularly polarized light (308) that exits light source lamp (101) again is reflected at parabolic reflector (102), and again becomes reversal circularly polarized light (309). Then, it passes through 1/4 wavelength panel (301), and becomes linear polarized light (310); however, as the main sectional planes of this 1/4 wavelength panel (301) and 1/4 wavelength panel (302) are mutually in orthogonal relationship, linear polarized light (310) is the p-polarized light to the dielectric multi-layer films, and it passes through said polarized light separator. And therefore, almost all the nonpolarized lights (304) which enter polarized light separator are converted to linear polarized lights.

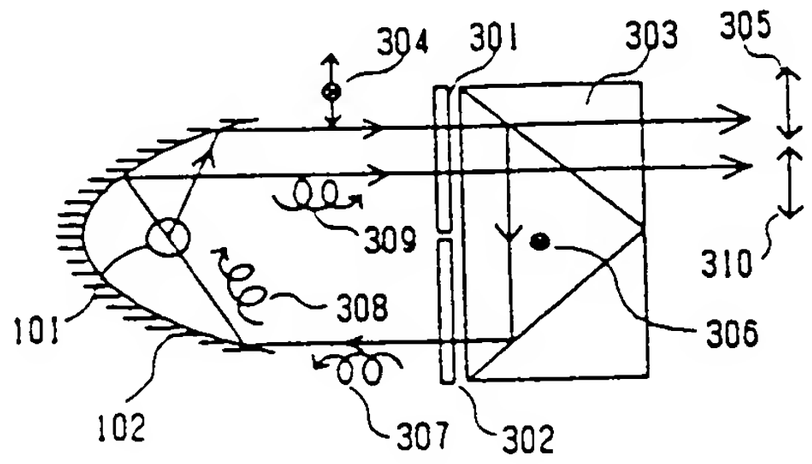
Figure 4 illustrates a constitutional plane view of projection type liquid crystal display device that is constructed by using this invention's polarizing light source device. Almost all nonpolarized lights (408) from a light source device comprising light source lamp (101) and parabolic reflector (102) are converted to linear polarized lights by 1/4 wavelength panel (401) and polarized light separator (402). Although 6 dielectric multi-layer films are used in order to reduce the thickness of polarized light separator in this polarizing light source device, it is of the same principles as shown in the Figure 3 that allows transmission of p-polarized light and reflection of s-polarized light. The linear polarized lights (409) discharged form polarizing light source device show angle dependence to the polarized light separator (402) and nonpolarized lights from the light source device are not the perfect parallel lights; and therefore, that degree of polarization remains insufficient to enter the liquid crystal panel (404), and show reduced contrast ratio of display screen as they are. And therefore, they are passed through polarization panel (403) to set to linear polarized lights with high degree of polarization. The luminous flux that enters this polarization panel (403) hardly includes s-polarized light varying from the nonpolarized lights (207) which enter the polarization panel (202) of the case of conventional projection type liquid crystal display device shown in the Figure 2; and therefore, polarization characteristics of this polarization panel (403) show somewhat better degree of polarization of transmitted lights even though they may be inferior to the polarization characteristics of polarization panel (202) of conventional case. And therefore, as it is possible to utilize a polarization panel with poor polarization characteristics, that is to say, the one that shows high overall

Figure 4 illustrates a constitutional plane view of projection type liquid crystal display device that is constructed by using this invention's polarizing light source device.

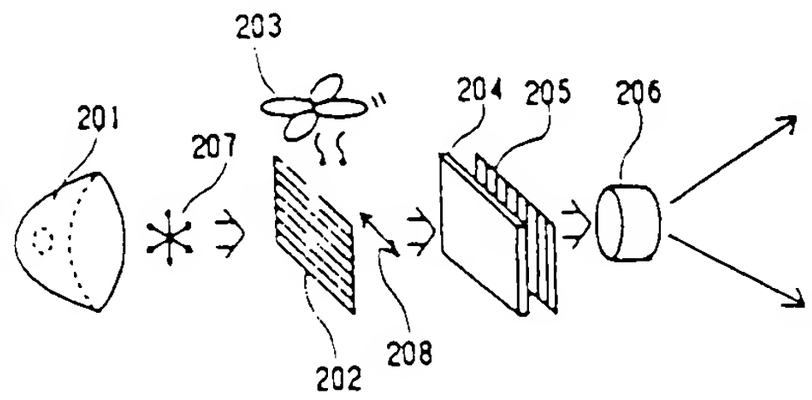
101... light source lamp
102... parabolic reflector
103... prism
104... dielectric multi-layer film
105... nonpolarized light
107... linear polarized light
202... polarization panel
204... liquid crystal panel
206... projection lens
301... 1/4 wavelength panel
303... polarized light separator
307... circularly polarized light
407... screen



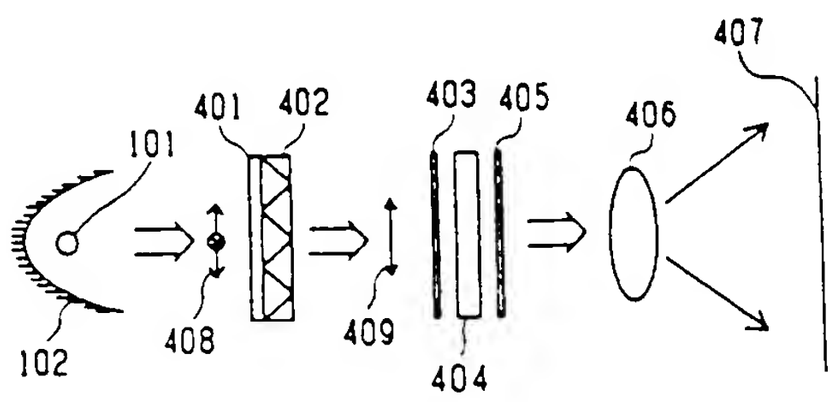
第1図



第3図



第2図



第4図

Translation requested by: Kari Bartingale
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